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SCIENCE

FRIDAY, OCTOBER 10, 1913

MEDICAL EDUCATION IN THE UNITED STATES¹

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HISTORICAL

THE first medical school in the United States was organized in 1765 in connection with the University of Pennsylvania by Dr. W. Shippen, the anatomist, and Dr. John Morgan, both of whom had been favorite pupils of the Hunters in London and were graduates of Edinburgh. The Harvard Medical School was founded in 1783 by Dr. John Warren, who had been a military surgeon in the army from the battle of Bunker Hill until ill health forced his retirement. Anatomy was taught by demonstrations, but in 1809 a room was opened which offered to students opportunities for dissection similar to those given by the Hunters in London. It is stated that these facilities were superior to those obtainable on the continent of Europe.

As time went on there was a great increase in the number of medical schools; the older schools either dropped their university affiliation or this became nominal. The "proprietary school" arose, in which a few practising physicians came together for the purpose of giving lecture courses and clinics to medical students during a period of five months each year. The students listened to the same courses during two successive terms and, after passing an examination, received the degree of M.D. eighteen months subsequent to the beginning of their medical studies. Attempts to raise the standard of medical education were always accompanied by a loss of fees,

¹ A report prepared for the International Conference on Post-graduate Medical Education held at the time of the Seventeenth International Medical Congress, London, 1913.

the mass of the students invariably going to the medical school which offered the medical degree in the shortest and cheapest manner. In the later days of the proprietary school, some of the faculties divided their fees so that each professor who had taught four hours a week, during five months in the year, received eight or ten thousand dollars for his services.

The schools not being endowed could not exist with a high standard. At first they served an excellent purpose in the widely separated and rapidly growing communities in which they were situated. It must be remembered how different the conditions were from those existent in the densely settled countries of Europe with their well-endowed institutions of learning.

Prior to 1870, no laboratories existed except those of anatomy, so that the expense of maintenance of the proprietary medical school could always be kept at a minimum, and large sums could be distributed among its beneficiaries. This was the general condition of affairs as late as fifteen years ago. Professorial positions were often obtained by the ability to control a hospital service, family influence or personal friendship. These conditions persist, in part, to-day. Many able men were thus drafted, but also many mediocrities achieved thereby unearned distinction in the community. The conditions existing in Harvard, one of the best schools, during the régime of the two-year course, showed that the student was compelled to listen to as many as five successive lectures on a single day between the hours of nine and two o'clock on such diversified subjects as *materia medica*, chemistry, medicine, obstetrics and anatomy. The last hour was assigned to anatomy, for Dr. Oliver Wendell Holmes was the only one who could hold the exhausted student's attention.²

² "Life and Letters of Oliver Wendell Holmes."

The old-time school, now little more than a memory, has been dwelt upon because of the powerful influence it has had in yielding a mass of mediocre physicians whose existence can not, in any other manner, be explained. Some American physicians kept abreast of the world's knowledge, but conditions were such that the great mass of their pupils were started ill-educated on their careers on account of lack of opportunity and lack of the inculcation of the right ideals. This faulty education could only be remedied in a few instances by personal industry or by foreign study. Eminent professors assured their students that they were receiving the best education the world afforded, and yet, in 1871, Germany had eighteen of its present twenty regularly established institutes of physiology, at the same time that Bowditch, fresh from Ludwig's laboratory, modestly offered to senior medical students "opportunities for original investigations in the laboratory." It was also in 1871 that Eliot introduced a graded three-year course at the Harvard Medical School. This was symptomatic of the broader cultural development of a provincial people which followed the struggles of the civil war, and yet it is only within the last ten years that laboratories, other than those of anatomy and gross pathology, have become acknowledged essentials of medical schools of the highest class. It is due to this fact that the discipline in anatomy was always strong and rigorous. The controlling influence over the anatomical department was the professor of surgery who had advanced directly through that path, and the younger men in charge of the dissections were practising surgeons who hoped to become skillful through exact anatomical knowledge. All emphasis was laid upon practical application, and a huge mass of memorized details were crowded into the brain of the submissive student.

The intimacy between anatomy and surgery and the rigor of the discipline did much to equip American surgeons with a practical power which was of great value. This relation is shown to-day in the examination questions asked by the old-school surgeon, which are frequently half of them questions of anatomy.

THE FIRST TWO YEARS OF MEDICAL EDUCATION

With the development of higher scientific standards, the teaching of anatomy has been turned over to specialists, preeminent of whom is F. P. Mall. The twenty leading medical schools in the United States have anatomical laboratories, in charge of full-time professors, with competent, trained assistants, engaged in teaching and research. These laboratories also embrace embryology and histology. Some of the laboratories have come under the influence of the teachings of the American biologists, of men like C. S. Minot, E. B. Wilson, T. H. Morgan, E. G. Conklin, Charles B. Davenport, R. G. Harrison and Jacques Loeb. The mention of these names is prophetic of accomplishment when American medical schools shall be so organized that they can produce masters of modern medicine.

Reference has been made to Bowditch's influence at Harvard, but physiology in America also owes an important debt to H. Newell Martin of the English school. Martin established a graduate school in physiology at the Johns Hopkins University in 1876, and inspired many of the best workers in the country in physiology and biology. At present the better medical colleges have well-equipped physiological laboratories with full-time professors. The English system of obligatory student instruction in the physiological laboratory has been adopted and extended in the United States.

For the development of physiological chemistry, the country owes much to Chittenden, who studied with Kühne, and who, with tireless energy and fine capacity, trained numerous pupils who have charge of departments of physiological chemistry to-day. Under the old proprietary school system, there was, necessarily, a professor of chemistry who taught the elements of the science. It has, therefore, been an easy task to develop a special department of physiological chemistry in connection with all of the better schools. This has been very helpful, since there has been no department of medical science the world over which has more broadly developed during late years. Practical laboratory exercises for all the students are compulsory.

The English can well realize the influence which Cushny, a pupil of Schmiedeberg, has exerted in establishing pharmacology in the United States. Through his pupils, and through Abel and Sollman and their pupils, medical students are, themselves, able to experimentally determine the behavior of drugs upon the anesthetized, functioning organism.

The new German pathology was introduced into the country, by W. H. Welch, at the Bellevue Medical College and by T. Mitchell Prudden, at Columbia, who were both in New York City during the seventies and early eighties. New York was not then a scientific center, and the Johns Hopkins University, in 1884, offered Welch a professorship of pathology, which subsequently led to the development of a life of great usefulness, of unselfishly exerted power, and well-deserved distinction. The spirit of the influence was shown in a speech at a dinner given in New York seven years ago in honor of Friedrich Müller when Welch said: "It is through the laboratory that Germany has attained her primacy in medicine, and she will not

yield that primacy *because she knows what is good for her.*" Many excellent men have been trained in Welch's laboratory and through them, as well as through pupils of Prudden, pathology is well taught in the better American schools. One very great handicap to medical progress lies in the laws relating to the autopsy of the hospital dead. In the seventies, when E. G. Janeway and Francis Delafield were laying the foundation of their masterful comprehension of the science of medicine, it was easy for them to follow the course of disease and see the results at autopsy if the patient died. But now the New York law forbids an autopsy without consent of the next of kin, instead of accepting the more rational plan of permitting autopsy unless objection is offered within twenty-four hours by the next of kin. The difficulties to be overcome before an autopsy is allowed are such that only 10 per cent. of the patients dying in Bellevue Hospital, with its twelve hundred beds, are actually autopsied. A grotesque reflection upon this foolish system is shown in the fact that these 10 per cent. of autopsies indicate incorrect diagnosis in a large percentage of the cases. The following is the record in one large public hospital of 390 autopsies in the year 1912, as compiled by Oertel.

	Cases	Per Cent.
Clinical diagnosis confirmed.....	87	22.3
Clinical diagnosis correct but important additional lesions found.....	116	29.7
Clinical diagnosis partly correct.....	54	13.8
Clinical diagnosis not confirmed.....	109	27.9
No clinical diagnosis.....	24	6.3
	390	100.0

If the physician were sure that, in case of death, his diagnosis would be checked by the pathologist, he would be likely to exercise greater care in his work, and he and his pupils would learn to better understand the limitations of diagnosis. Also, the value

of vital statistics would be immeasurably enhanced.

This very ill-advised policy on the part of the law-making power has had a further effect of discouraging pathological morphology, so that many pathological laboratories have turned attention to experimental pathology or experimental medicine, for which latter separate departments have sometimes been instituted. The enforced neglect of morphological pathology has been a grave obstacle in the path of medical progress.

THE SECOND TWO YEARS OF THE MEDICAL COURSE

For thirty years, it has been possible to train laboratory workers in the medical sciences according to the best principles, and in increasing measure both men and opportunity have been developed. It seems passing strange that, with all this activity, it is only very recently that the clinical situation has been touched. Men have passed through the schooling of the laboratories, and then, for two final years of education, have been, and usually still are, turned over to clinicians the majority of whom have had no laboratory training, and the student has graduated, and still graduates, without knowing the application of the fundamental medical sciences to the practise of his profession. Halliburton has epitomized the situation in the words, "The student forgets his physiology at the bedside." It is well for the clinician to assure the teachers of the fundamental sciences that they do best when they emphasize the importance of the practical application of their scientific knowledge, but this is only half the story. The more important half lies in the necessity that the clinical teacher should know in what way the fundamental sciences are helpful in the understanding of medicine.

The conditions in the United States have only recently so begun to improve that there begins to be a distinct incentive for a young clinician to definitely formulate a career as a medical teacher. Three years ago, in New York City, there was no hospital which could offer a continuous service. If any one were interested in scientific research, he might work for three months in his wards, at the end of which time he was turned out by a successor who might care nothing for research. The admirable example of the close affiliation between the hospital and medical school at the Johns Hopkins was long ignored. The whole situation was most unsatisfactory from an educational standpoint.

At the present time Columbia has formed an affiliation with the Presbyterian Hospital, the Cornell Medical School one with the New York Hospital, similar alliances exist in Cleveland, St. Louis and in other localities and, in Boston, the Harvard Medical School controls the appointments to the Peter Brent Brigham Hospital. The arrangements are, for the most part, temporary and experimental. The last-named union has enabled the new Brigham Hospital and the Harvard Medical School to attract from different parts of the country some of the best minds in the United States. It is of happy augury that men who, often at the expense of poverty and mental anxiety, of illiberal criticism and even of personal abuse, have labored to attain high professional rank through scientific endeavor, should be given the opportunity to achieve a better condition of medical scholarship. There is here embodied the true spirit of the possibility of conquest of the material by the intellectual. The appointments at Harvard were made for merit and were not due to local celebrity or to the desire to satisfy relatives or personal associates. Of all the traditions

inherited from the days of the proprietary school, the faculty perquisite of the appointment of local mediocrity to important clinical positions dies the hardest. It is still too easy to appoint to a professorship a man without scientific or educational interests. Yet such misuse of power is gradually becoming less and less possible.

There has been much discussion of late years regarding the duties of a university professor of a clinical subject. Effort has been made to have him renounce all private practise. This ideal state has not yet been put to the test but arrangements are now in progress for its introduction into one of the best schools. President Vincent, of the University of Minnesota, presents the unsolved problem of the clinical teacher in the following words:

You realize how difficult it is to persuade a man who is making \$25,000 a year from his practise on the outside to accept a position of \$3,000 on the inside. If you can get hold of the unsophisticated medical man before he owns an automobile, much may be accomplished, but after he once yields to the insidious motor car, nothing can be done in the way of regeneration.

The best class of university professors accept only a strictly consultation practise and do not receive patients for treatment except in their own hospitals. The professor of medicine at Columbia has devoted five hours daily to his work in the school and the affiliated Presbyterian Hospital, and his associate does not practise. Herein lies the kernel of reformation. The university should emphatically require that the welfare of its affiliated hospital, the patients therein and the throng of young physicians who are being educated, should be considered as of at least equal importance to the maintenance of regular office hours by the physicians in charge. Progress in the right direction is now being accomplished. The increasing spirit of

scientific research among the younger men is sign of hope for the future.

The hospital teaching of medical students is being rapidly improved by the introduction of the English system of clinical clerks, which was first used in America by Osler at the Johns Hopkins. Patients are assigned to different students who follow carefully the course of the disease, using laboratory methods, and perhaps finally preparing a thesis upon a group of cases or some particularly interesting case, presenting also the literature concerning similar cases. Some of these theses are worth publishing and thus approach the German "Doktorarbeit."

The special medical subjects, such as the eye, ear, etc., are treated by local specialists, as is the custom elsewhere. At the Johns Hopkins, special hospitals for psychiatry and for pediatrics have recently been opened and placed under the direction of first-class men.

After receiving his diploma, the medical student usually spends a year or two as a hospital interne. The Council on Medical Education of the American Medical Association reports that of 2,004 physicians graduating during a year from 40 of the better class medical schools, 1,403 or 70 per cent. received hospital internships. At Harvard, 90 per cent. of the men followed this custom. It is strongly advised by the council that a year of hospital internship be made compulsory before license to practise medicine is allowed. The 4,000 hospitals in the country would afford ample facilities.

Mention should be made of the influence of the Rockefeller Institute in New York, the McCormick Institute for Infectious Diseases and the Sprague Memorial Institute in Chicago, the Wistar Institute of Anatomy in Philadelphia and other examples of well-endowed research insti-

tutions which, for the most part, have set an example of idealistic accomplishment that has been of aid to the development of higher aims of medical achievement. It would be of little value to set forth at this time the extent and cost of buildings devoted to medical education in the United States for the essential factor is the spirit of the institutions themselves rather than their material embodiment. In commenting on the behavior of a certain young professor who complained that he could not work on account of lack of laboratory facilities, Carl Voit once said: "Er ist faul. Er will nicht arbeiten. Man kann in einem ganz kleinen Zimmer arbeiten." It is not lavish expenditure but the right spirit that is needed.

INFLUENCE OF AGENCIES FOR PUBLIC WELFARE

There have been various helpful agencies at work which have wrought wonderful advances in medical education in the United States. The country is thought to be naturally conservative, and the medical profession especially so. The cause of this is partly explained by quoting Vincent again.

They (the American people) usually display hostility or, at least, derisive disrespect for the specialized and their opinions. To the unspecialized average man, the expert is in a way a personal affront. He suggests the idea of a superior class and seems to reflect on the competence of the ordinary citizen. This feeling is a natural survival of the early days, especially on the frontier.

To complete the picture and show how difficult is reform in America, whether of medical education or of the tariff or of the currency, one has only to recall the remark of A. B. Macallum that the progress of the world is accomplished by one thousandth of one per cent. of its inhabitants.

The battle for correct principles and ideals regarding medical education has

been waged by certain of the medical men themselves who have been unsparing critics of the old-fashioned methods.

Helpful agencies have been especially the Council on Medical Education of the American Medical Association composed of six individuals, and Abraham Flexner, who prepared a report on the condition of the medical schools of the country for the Carnegie Foundation.

The medical problem is not a simple one. There are 49 states and each state has its own examination for the license of its physicians. There is no national control, and the standards vary greatly. Thus, in twenty-seven states, the law gives the licensing board the power to refuse recognition to the graduates of low-grade medical colleges, a power too little made use of. In four states, it is not even necessary that an applicant for medical license be a graduate of a reputable medical college, and the authorities of Tennessee, in 1912, presented the spectacle of licensing 175 individuals who were not graduates of any medical school whatever.

In 1904, when the Council on Medical Education began its activities, there were 166 medical schools in the country, which was about one half of the world's supply. There are now 110 in contrast with 21 in England, 20 in Germany, 20 in Italy and 5 in France.

The reduction in the number of medical schools by extinction or merger has been the happy outcome of severe and public criticism. The Council on Medical Education set to work to bring about conformance to certain standards which may be thus abbreviated: (1) A higher entrance requirement which includes a year's work in chemistry, physics and biology, as given in the universities. (2) The presence of at least six full-time professors in the fundamental sciences in charge of thor-

oughly equipped laboratories in which the student works during his first two years. (3) Two years of clinical work in hospitals and dispensaries. (4) A post-graduate year as interne in an approved hospital. (5) The medical teaching to be of high excellence.

As an instance of notable accomplishment, it may be stated that whereas in 1904 only four of the 166 medical colleges required more than a four-year high school course for entrance, and the majority of the others admitted all who applied, at present sixty medical schools have adopted the higher entrance requirements and six states have adopted two years of university work as a necessary preliminary to the medical course.

An effective stimulus to medical education has come through the grading of medical schools into four different classes. This has been done as the result of personal inspection. The Council has recently published its third grading. In Class *A* Plus there are 22 acceptable medical colleges giving a four-year course. In Class *A* there are 31 colleges lacking in certain respects but otherwise acceptable and giving a four-year course. In Class *B* there are 22 colleges needing general improvement to be made acceptable and giving a four-year course. In Class *C* there are 27 colleges requiring complete reorganization to make them acceptable. Besides this, there are eight institutions offering only the first two years of medicine and there are four schools for the colored race, two in Class *A* and two in Class *C*.

The publication of these classifications has been of inestimable benefit in creating public sentiment against unworthy institutions. The work was greatly advanced in the Flexner report which gave detailed descriptions of abominable conditions in low-grade schools. Dr. Henry S. Pritchett,

head of the Carnegie Foundation, has recently stated that the full power of the foundation, to whatever extent may be necessary, will be used in the crusade against the worthless medical schools throughout the country. It is certainly right to insist upon the closing of a diploma mill, the physiological apparatus of which consists solely of a sphygmograph, when, in the same city, a physiological laboratory exists in which the annual budget reaches \$30,000, and yet these two different medical institutions have been maintained under the laws of the same state, and, until this year, their graduates have been treated on equal footing by the state board of examiners. The fact that this low-grade school does not appear in the list of fully registered colleges this year shows how the state can use its power to protect its citizens. The legal power to defend the community from the ill-educated lies with the state boards who examine for the license to practise. In 1912, 5,466 physicians were so licensed as the result of examinations in the various states. A common standard would be highly desirable which would allow a physician licensed in one state to practise in another. At present it may happen that an impostor driven from one state can readily obtain a license to practise in another, and there continue his misdeeds. This condition of affairs will not much longer be tolerated.

CONCLUSION

It is lightly stated by some that the best American schools are equal to those of Europe. It would be satisfying if one could really believe that this were true. The American has never been self-satisfied and he is outgrowing his ancient habit of boasting, but he has always desired the best and there is much hope that out of

present conditions he will some time evolve the best.

APPENDIX

1913. *Class A Plus*.—Acceptable medical colleges well organized and thoroughly equipped, giving acceptable courses and requiring for admission one or more years of university science. Prepared by the Council on Medical Education of the American Medical Association.

State	Town	Institution
California,	San Francisco,	Leland Stanford, Jr., University.
	San Francisco,	University of California.
Connecticut,	New Haven,	Yale Medical School.
Illinois,	Chicago,	Northwestern University Medical School.
	Chicago,	Rush Medical School (University of Chicago).
Indiana,	Indianapolis,	Indiana University Medical School.
Iowa,	Iowa City,	State University of Iowa.
Louisiana,	New Orleans,	Tulane University of Louisiana.
Maryland,	Baltimore,	Johns Hopkins University Medical Department.
Massachusetts,	Boston,	Harvard Medical School.
Michigan,	Ann Arbor,	University of Michigan.
Minnesota,	Minneapolis,	University of Minnesota.
Missouri,	St. Louis,	Washington University Medical School.
New York,	New York,	Columbia University.
	New York,	Cornell University.
	New York,	New York University and Bellevue Hospital Medical School.
	Syracuse,	Syracuse University.
Ohio,	Cincinnati,	University of Cincinnati.
	Cleveland,	Western Reserve University.

Pennsylvania, Philadelphia, University of Pennsylvania.
 Texas, Galveston, University of Texas.
 Virginia, Charlottesville, University of Virginia.

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GRAHAM LUSK

CORNELL UNIVERSITY MEDICAL COLLEGE,
 NEW YORK CITY

THE BOTANICAL EXPLORATION OF
 AMBOINA BY THE BUREAU
 OF SCIENCE, MANILA

GEORGE EBERHARD RUMPF (Latin Rumphius)
 died in Amboina, Netherlands East Indies, in

the year 1702, after a period of residence there of about thirty years. Some years after his death there was published in Amsterdam, under the editorship of J. Burmann, his great botanical work, the "Herbarium Amboinense." This monumental work consists of six folio volumes, comprising about 1,660 pages and 669 plates with approximately 960 figures, and with the accompanying "Actuarium" was published during the years 1741 to 1755. Linnæus did not receive a copy of the published parts until too late to incorporate the plants described in his "Species Plantarum." The work, then, as to nomenclature is pre-Linnæan, although binomial designations for the plants described are abundant in it.

The "Herbarium Amboinense" has at all times since its publication been a work of great botanical interest and is to-day one of the basic works for the student of the Malayan flora. For the proper interpretation of many species proposed by later authors, by citation of Rumpf, reference to the "Herbarium Amboinense" is absolutely essential.

In 1754 Olof Stickman, one of Linnæus's students, published his dissertation entitled "Herbarium Amboinense," a small pamphlet of 28 pages, which was reprinted by Linnæus in 1759 in his "Amœntates Academicæ," IV., pp. 112-143. In this work somewhat over 300 of the plants figured by Rumpf are reduced to species proposed by Linnæus in the first edition of his "Species Plantarum" (1753), or, by citation, are made the types of new ones. Constant references are made by Linnæus to the "Herbarium Amboinense" in his later works, so that very many of Rumpf's crude figures have become, by citation, the actual types of many Linnæan species. Later still other such species were proposed by Roxburgh, and by other authors, and Rumpf's plates are constantly being cited by modern authors in monographs and in papers on the Indo-Malayan flora.

Rumpf's plates, in many cases decidedly crude, being the only means by which a large number of proposed species can be interpreted, various attempts have been made more definitely to settle the status of the plants